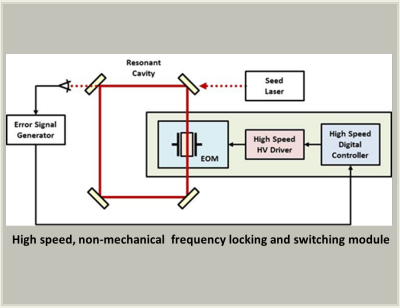
High Speed Frequency Locking Module for Lidar Based Remote Sensing Systems, Phase I

Completed Technology Project (2017 - 2017)

Project Introduction

A fundamental requirement for all Differential Absorption Lidar (DIAL) systems is wavelength switching of the probe laser on and off of an absorption line of the species of interest. For most trace gas species it is also required that the accuracy of the switching be on the order of 10 MHz. Further complications for many DIAL measurements are that the platform for the system moves, such as an airplane or spacecraft, and that the lasers used are often high peak power, pulsed lasers. The combination of a moving platform, pulsed laser, and the requirement that the online and offline measurements be made in essentially the same volume implies that the switching time between online and off line measurements be less than ~ 1 ms, and many cases even shorter. To date, most lasers used in DIAL systems rely on piezo-electric (PZT) mechanisms to perform the cavity length changes needed for the frequency switching. In practice, this limits wavelength switching speeds to a few hundred Hz. This relatively slow frequency switching prevents researchers from fully exploiting DIAL systems utilizing the high efficiency, multi-kHz lasers or the lower repetition rate, dual pulse lasers systems that are now available. In order to improve the wavelength switching speeds needed to fully exploit the capabilities of airborne and space-based DIAL systems, Fibertek is proposing to develop a high speed, non-mechanical frequency locking module that allows shot to shot frequency switching of single-frequency lasers at up to 3 kHz with a spectral resolution of <10 MHz. Our approach to the proposed locking module is an innovative synthesis of all electro-optic (EO) based switching and locking, a compact and efficient EO driver design that reduces voltage requirements by 4x over conventional designs, a novel EO voltage that's profile that eliminates electrochromic darkening, and a larger off-set locking capability that eliminates the requirement for an additional phase shifter in the cavity.



High Speed Frequency Locking Module for Lidar Based Remote Sensing Systems, Phase I Briefing Chart Image

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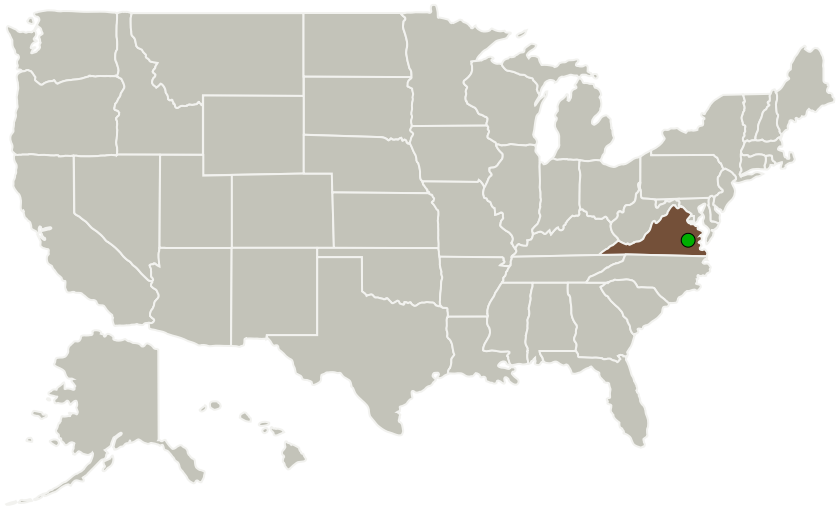
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Fibertek, Inc.	Lead Organization	Industry	Herndon, Virginia
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations
Virginia

Project Transitions

June 2017: Project Start

December 2017: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140761)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Fibertek, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

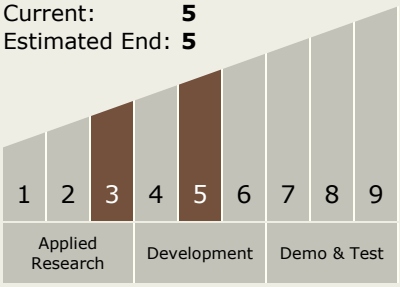
Carlos Torrez

Principal Investigator:

Jeremy Young

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



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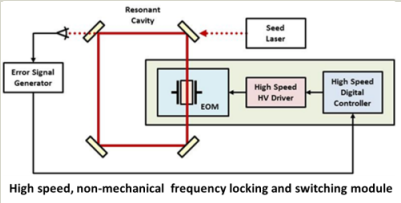
Images



Briefing Chart Image
High Speed Frequency Locking Module for Lidar Based Remote Sensing Systems, Phase I Briefing Chart Image
(https://techport.nasa.gov/image/136844)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.5 Lasers